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Health Mobilization Series

F-5

Operation of Generators in the Civil Defense Emergency Hospital

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U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE
Public Health Service

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Operation of Generators in the Civil Defense Emergency Hospital

U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE
Public Health Service
Division of Health Mobilization
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*Instructions for artificial respiration, mouth-to-mouth method,
are on inside of back cover.*

INTRODUCTION

In the event of a thermonuclear attack on the United States, a major proportion of existing hospital facilities would be destroyed. At the same time, there would be an unprecedented need for hospital beds and services. To help alleviate this problem, Civil Defense Emergency Hospitals (CDEH's) have been acquired by the Federal Government, loaned to States, and stored in communities throughout the country.

The CDEH is a unit of supplies and equipment which, in disaster, can be set up in an existing building, such as a school, and, when staffed, can provide essential medical and surgical care for 200 bed-patients at one time. A CDEH can also be used to augment the supplies and equipment of an existing hospital, thus permitting it to expand operations in a disaster. Community health and civil defense leaders who are responsible for the storage of a CDEH are also responsible for preparing for its use in disaster. This booklet, one of a series on preparing to use a CDEH, deals with preparations to use the electrical generating equipment that is included in each CDEH.

PREPARING TO USE THE CDEH ELECTRICAL GENERATING EQUIPMENT

Following a major disaster, normal supplies of electrical power are likely to be disrupted and may not be restored for some time. For this reason, each CDEH contains gasoline-electrical generating equipment of sufficient capacity to meet the emergency hospitals operating requirements.

For those with requisite skills, this equipment is relatively easy to set up and operate. If the job is to be done with a minimum of delay and confusion, however, certain predisaster preparations should be carried out now. These include:

1. Assigning responsibility for setting up and operating the equipment in disaster. (Assignments should include at least one electrical and one engine mechanic.)
2. Familiarizing assignees with the equipment and with setting up and operating procedures.
3. Arranging for provision in disaster of certain items which must be provided locally to permit successful operation.
4. Examining the building in which it is tentatively planned to house the CDEH in disaster and preparing a wiring diagram to show how the generators will be tied into the existing wiring or otherwise connected to the electrically powered hospital equipment.

This booklet is intended primarily for those electricians and engine mechanics who may have to operate the CDEH generators in disaster. It provides enough information to permit setting up, connecting to equipment, and operating any of the various model generators which have been provided in CDEH's.

Note: It is assumed that those assigned responsibility for setting up and operating the equipment have knowledge and skills comparable to those of an automobile mechanic or a licensed electrician. Experience with gasoline engine-driven electrical generators is not assumed.

The booklet will be most effective when used in conjunction with practice sessions in which CDEH generating equipment, which has been made available for training purposes, is actually set up and put into operation. More detailed information concerning the operation and special features of individual generator models will be found in a manufacturer's manual which is packed with each generator.

In addition to fuel, several supply and equipment items necessary for connecting and using the generators must be provided from local sources. These items are listed for each model of generator on page 56. *CAUTION: Operators should exercise extreme care in working with this equipment because of the lethal shock hazard. They should see that all hospital personnel are aware of this hazard and that they are protected to the maximum possible extent. (See artificial respiration procedure on inside back cover.)*

THE 15-KILOWATT GENERATOR

A. GENERAL DESCRIPTION

There are five models of the 15-kw. generator in the Model 53 through 57 Civil Defense Emergency Hospitals:

<i>Generator Nos.</i>	<i>Model</i>
Eseco Division, B-4836 (Contract GS-03S-16956).....	B
John R. Hollingsworth Co., JHE-15 (Contract GS-03S-13040)...	J
Winpower Mfg. Co., K-921-1 through K-921-200 (Contract GS-00S-2136).....	K
Winpower Mfg. Co., M-1000-1 through M-1000-1004 (Contract GS-00S-14625).....	M
Winpower Mfg. Co., U-932-1 through U-932-10 (Contract GS-00S-34986).....	U

The 15-kw. generator sets covered by this manual are similar in nature and many of the instructions apply equally to all. Where differences exist, the text contains special notations which refer by the above model letters to the specific model or models to which the instructions apply. The model can be determined from the contract number which is stamped on the outside of the crate. The generator number is also found on the name plate affixed to each generator.

The 15-kw. generators are capable of 15-kw. output, 60 cycles at 1,800 r.p.m., at 0.8 power factor. Models K, J, and B: 120/208-volt, 3-phase, 4-wire, WYE connected. Models M and U: changeover switch included to supply 240/416 volt, 3-phase, 4-wire as well as 120/208-volt service.

Note: These units are packed with the switch in the 120/208-volt position. It should be left in this position.

1. Engine

Gasoline, liquid-cooled, 4-cylinder, 4-cycle of approximately 36 horsepower, direct-coupled to generator. Engine is equipped with automatic speed control governor to maintain 1,800 r.p.m. Engine has a 6-volt electrical system and provision for manual cranking.

2. Housing

Engine and generator are directly coupled and mounted on a steel frame equipped with skids. The entire generator assembly is equipped with a sheet steel housing which is adequate to protect it from most weather. Removable panels or hinged doors are provided for access to the equipment.

3. Accessories

Accessories packed with each generator model are listed on page 56.

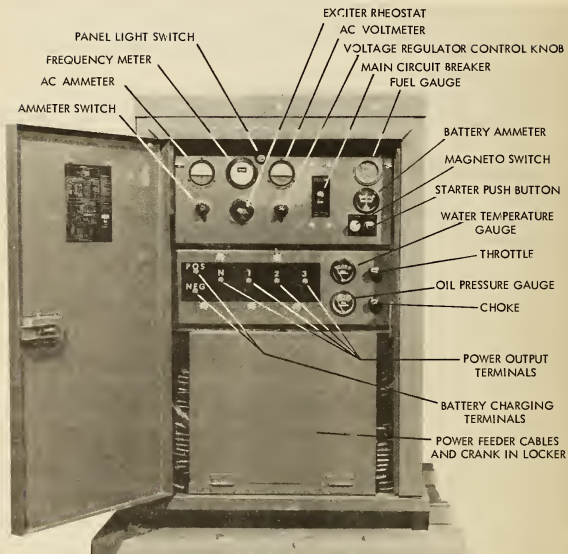
4. Identification of Components

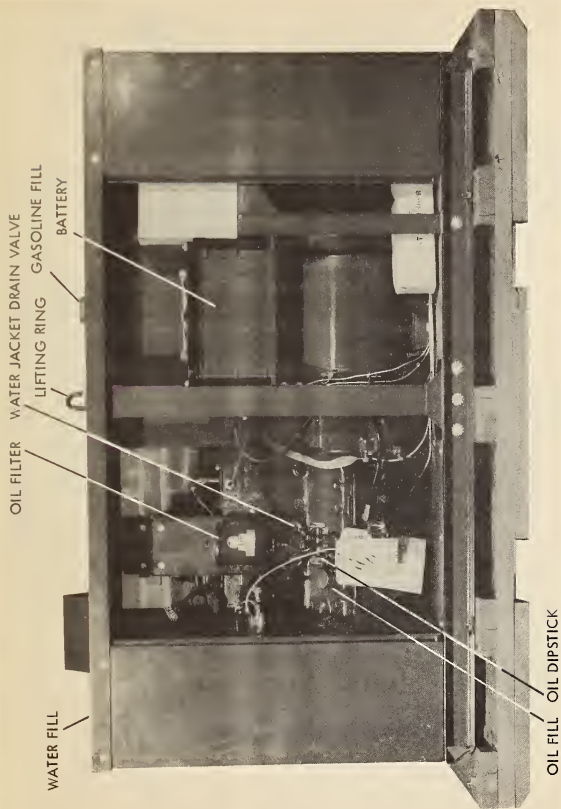
See illustrations on the following pages for identification and location of principal controls and components of each model.

MODEL B, 15-KW. GENERATOR

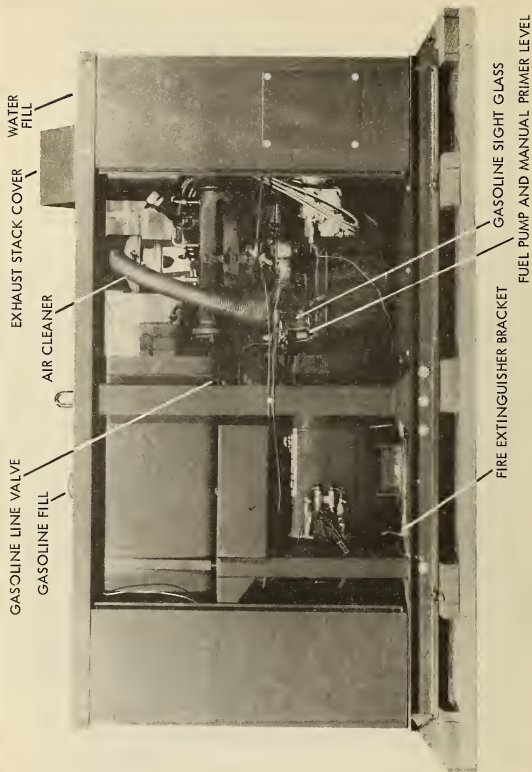
Front

Eseco Division, B-4836





MODEL B, 15-KW., Left Side

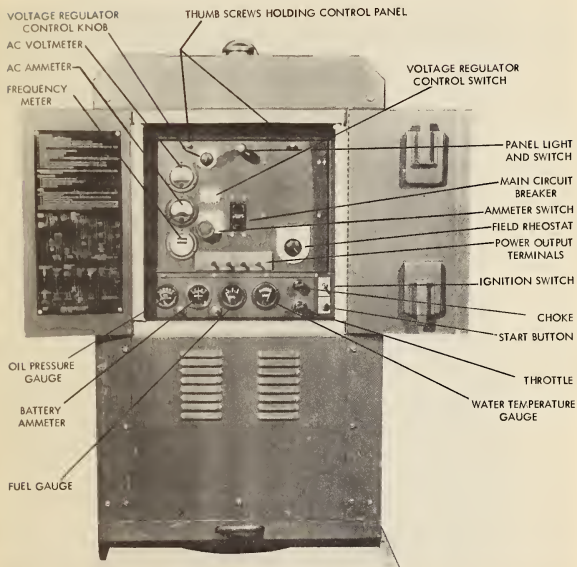


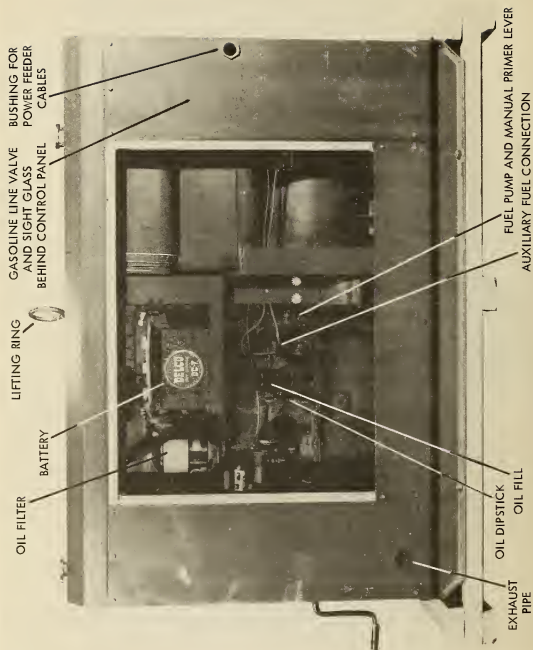
MODEL B, 15-KW., Right Side

MODEL J, 15-KW. GENERATOR

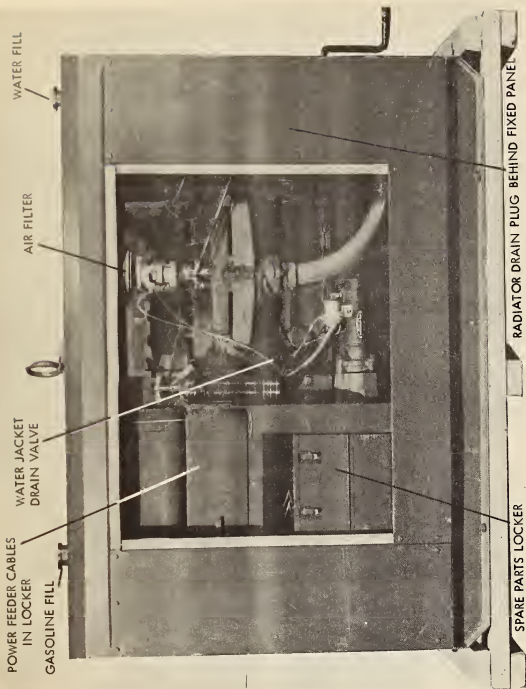
Front

John R. Hollingsworth Co., JHE-15





MODEL J, 15-KW., Left Side

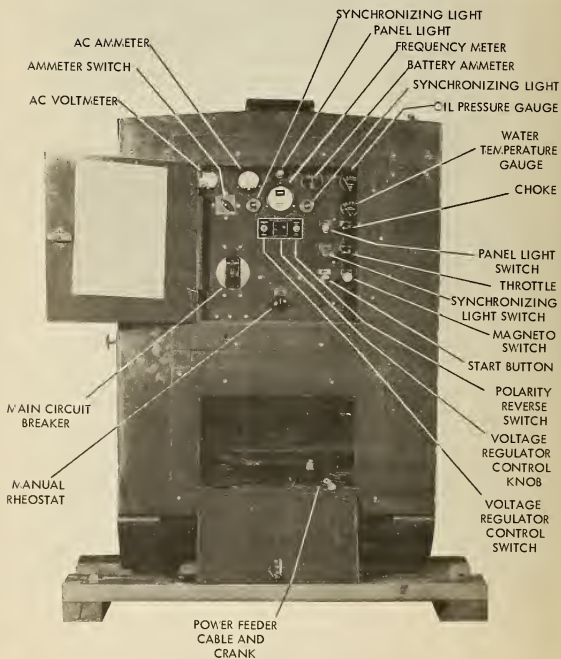


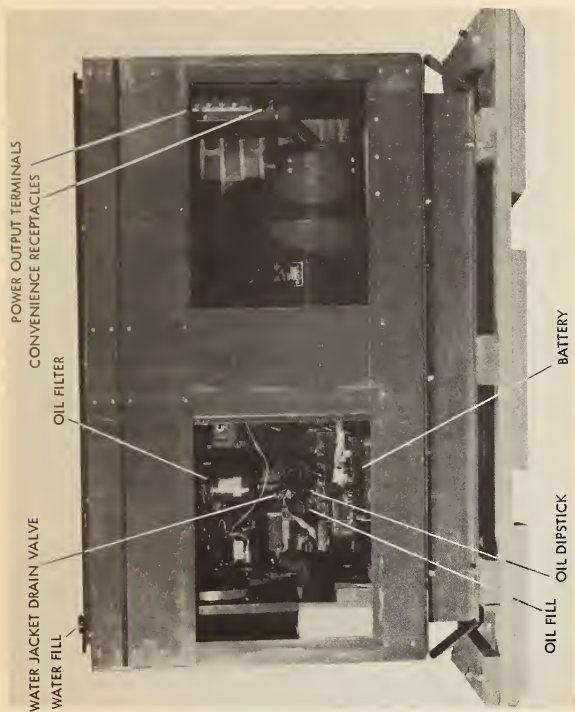
MODEL J, 15-KW., Right Side

MODEL K, 15-KW. GENERATOR

Front

Winpower Mfg. Co., K-921-1 through K-921-200





POWER OUTPUT TERMINALS

CONVENIENCE RECEPTACLES

OIL FILTER

WATER JACKET DRAIN VALVE

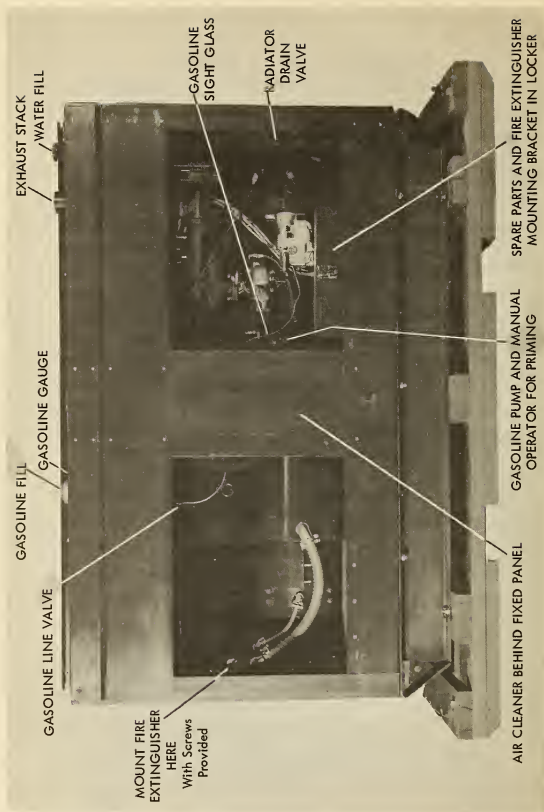
WATER FILL

BATTERY

OIL DIPSTICK

OIL FILL

MODEL K, 15-KW., Left Side



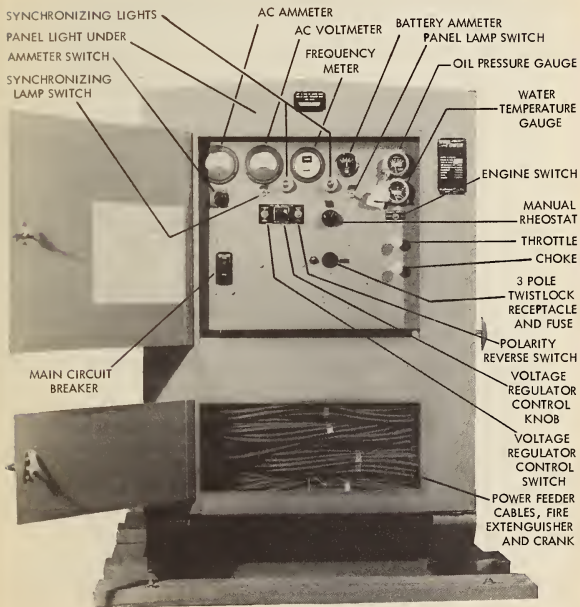
MODEL K, 15-KW., Right Side

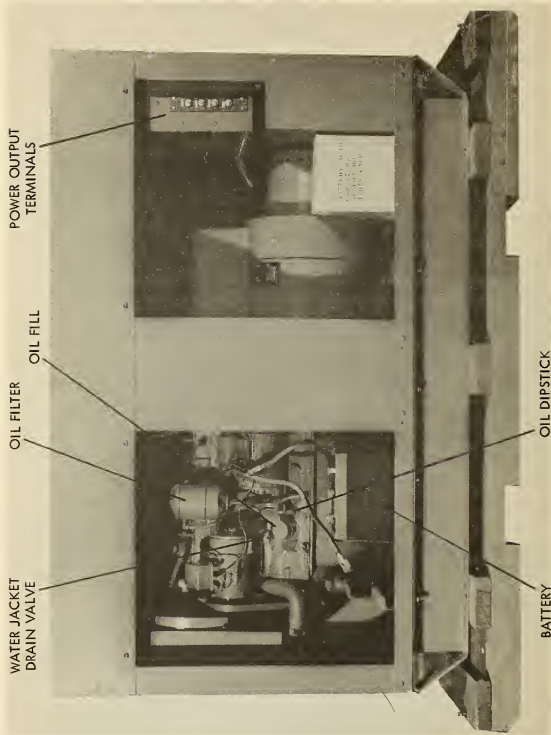
MODELS M and U, 15-KW. GENERATOR

Front

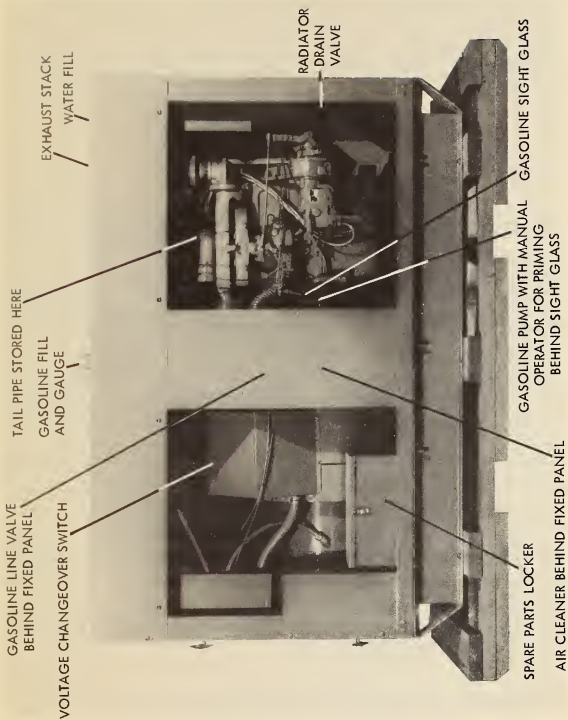
Winpower Mfg. Co., M-1000-1 through M-1000-1004

Winpower Mfg. Co., U-932-1 through U-932-10





MODELS M and U, 15-KW., Left Side



MODELS M and U, 15-KW., Right Side

B. PREPARATION FOR USE

1. Location

The generator set should be located outdoors for best ventilation, and to lessen exhaust gas and noise problems. In the extreme circumstance where it may be necessary to place the set inside a building, provision *must* be made to vent the exhaust pipe to the outside and to provide sufficient ventilation for the cooling system. It is also necessary that the exhaust pipe be provided with an insulating sleeve where it passes through walls and should be at least 2½ inches away from flammable material. Exhaust systems presently are not equipped with extensions for tail pipes.

2. Uncrating and Moving to Position

Ideally, the engine-generator set should be stored as close as possible to its planned operating location. Often, however, this will not be possible and it must be moved at the time it is to be used.

With its packing case removed, the generator set weighs approximately 1,750 pounds. If a 1-ton capacity forklift, mobile A-frame or other mobile lifting device is available it will simplify handling. Only Models B and J are equipped with lifting rings.

All models are equipped with steel skids and can be moved to position using pipes or rollers and manpower. To accomplish this at least five men should be available. Also, cables can be attached around the skids for moving.

The generator set is easier to move if the outer packing materials are removed first. Do not open the doors or detach the removable panels of the steel housing until the unit is in the operating position.

Locate the generator within 80 or 90 feet of the building's electrical distribution panel and as far from hospital ward areas as practicable to lessen the noise problem. Locate so that exhaust fumes are directed away from windows and doors.

Place the unit so that the control panelboard end will be facing the building's electrical distribution panel.

3. Assembly

Remove the side panels and assemble components as follows:

- a. Remove battery electrolyte (acid) containers from housing and set them aside for immediate use.
- b. Remove crank handle from its storage position and set in cranking position.

c. Remove fire extinguisher from its carton and fit it into bracket provided. (Model K bracket is packed in spare parts locker and must be mounted to frame of housing. Model J fire extinguisher is stored in place.)

d. Remove cover on end of generator (opposite engine) and see that brushes are clean and firmly seated on slip rings. Remove any protective paper that may be found on the slip rings.

e. See that fan belts and blades can run freely without interference with other parts of the engine.

Note: *Refer to manufacturer's manual for parts identification.*

4. Engine

a. Remove the battery from the generator to a place where battery acid, if spilled, will do no harm. Open the container of battery acid, remove the cell caps of the battery and fill the cells to a level just above the top of the battery plates. An indicator shows the proper level. The fluid should be divided approximately equally among the three cells. *CAUTION: Use extreme care in filling. This acid can cause severe burns and will damage many materials.* For added safety, a glass or plastic funnel should be used for filling. After filling the cells, secure the battery in its frame and connect the leads provided. The flat, braided conductor is the ground and must be connected to the positive terminal, marked +. (Models M and U battery cables are identical. The ground cable is bolted to the housing frame behind the central fixed panel of the housing.)

b. Remove the carburetor air cleaner and fill to the indicated level with lubricating oil of the same type as used in the crankcase. (Model B: while the instructions on the air filter call for No. 10 oil, crankcase oil is satisfactory for this use.) Replace air filter and be sure it is firmly seated.

c. Remove oil dipstick and set in a clean place temporarily. This will allow a release vent for air while the oil is being poured.

d. Check crankcase drain plug and empty crankcase of any preservative that it may contain. Empty into a container for safe disposal. Replace drain plug.

e. Remove oil filler cap and fill crankcase with 10W-30 oil or its equivalent. Four and one half quarts of oil are required.

f. Check oil level with dipstick. Oil level should be slightly above the full mark. The oil filter will retain one-half quart when the engine is started.

g. Check the drain valves on the radiator and engine water jacket to be sure they are closed. (Model J radiator is equipped with a drain plug. Be sure it is closed.)

h. Fill the cooling system with approximately 12 quarts of clean water. In cold weather, heating the water almost to the boiling point will help in starting the engine. (See p. 27 for use of antifreeze.)

i. Fill gasoline tank. Use regular or premium gasoline with an octane rating of 80 or higher.

Note: See fuel supply suggestions (p. 26). Where generator is located inside a building, fill tank carefully. Allow sufficient time for the dissipation of gasoline fumes before starting engine.

j. Open fuel valve under gas tank and be sure fuel flows into glass fuel cup. If cup does not fill readily, operate the manual priming lever until cup is full.

k. Models M and U: Assemble tail pipe to exhaust stack. Be sure it points away from control panel.

5. Generator

a. Remove the power cables from their storage point and connect an end of one of the cables to the neutral power outlet terminal.

Models K, M, and U: Neutral terminal is lowest of four and marked N.

Model J: Neutral terminal is at the extreme right and marked T_0 .

Model B: Neutral terminal is on left (near POS. and NEG. battery terminals) and marked N.

Note: It is important that the neutral wire be connected at both ends before the other three wires are strung since all four are the same color and easily confused.

b. Connect the other end of this same cable to the neutral of the desired distribution system for the hospital.

c. In order to provide proper grounding, dig a hole near the generator about 12 inches in diameter by 12 inches deep. Drive a pipe, preferably 5 or 6 feet long, into the ground at the bottom of the hole until

the top of the pipe is just above original ground level. Use a piece of wire of the same gauge as the power cables, long enough to reach from the pipe to the generator, strip it of any insulation and connect the bare wire securely to the pipe just below its top and drive the pipe the rest of the way down. Dig a shallow trench from this ground rod to the generator, lay the bare wire in it and replace the earth removed from both the trench and the hole. Connect the bare ground wire to the grounding stud provided on the frame of the generator. Continue the wire up to the power terminals and connect it to the neutral terminal to which the neutral power wire has just been connected.

Note: If there is a water pipe (not fuel or gas) nearby, use this instead of the ground rod. The other connections should be the same in either case.

d. Connect one end of each of the other three power cables to the remaining three power output terminals.

Models K, M, and U: Terminals marked A, B, C.

Model J: Terminals marked T_1 , T_2 , T_3 .

Model B: Terminals marked 1, 2, 3.

e. Connect the other ends of these three cables to the three phase terminals of the desired distribution system. Phase rotation does not matter; any of the three may be connected to any of the terminals, one to each. *CAUTION: Be sure that there is no connection between terminals or between wires. Such a connection would cause a short circuit and could damage or destroy the generator.*

f. Be sure the main circuit breaker on the generator control panel and all the circuit breakers or fused branches in the distribution system are in the OFF position.

g. Protect the power wires by elevating them and securing them to trees, walls, etc. Keep them off floors and the ground. *CAUTION: These wires may not be completely waterproof and allowing them to remain on the ground or floor where they may be subject to damage or water could be dangerous to personnel.*

C. STARTING AND STOPPING ENGINE

1. Controls should be set initially as shown in fig. 1, below.

Control	Setting				
	Model B	Model J	Model K	Model M	Model U
Main circuit breaker.....	Off	Off	Off	Off	Off
Ammeter switch.....	1	Off	Off	Off	Off
Voltage regulator control switch.....		Off (man.)	Off (man.)	Off (man.)	Off (man.)
Field rheostat knob.....		Extreme left			
Manual rheostat knob.....			Extreme left	Extreme left	Extreme left
Exciter rheostat.....	Extreme left				
Voltage regulator control knob.....	Center	Center	Center	Center	Center
Throttle.....	½	½	½	½	½
Oil pressure gauge.....				Press release button	Press release button
Choke.....	Out	Out	Out	Out	Out
Synchronizing lamp switch.....			Off	Off	Off
Ignition switch.....		On			
Magneto switch.....	On pull out				
Engine switch.....			Center	Center	Center

Figure 1

2. Start the engine as follows:

a. Operate fuel pump manually (with lever at base of fuel pump) four or five strokes to force a little gasoline into the carburetor.

b. Holding choke control in one hand, press start button with other. As engine turns, press choke control in slowly to avoid flooding. When engine fires, release start button and manipulate choke control to obtain smoothest operation. As engine warms, press choke control in. *CAUTION: Never run a warm engine with the choke even partially pulled out.*

c. If engine turns over but does not start immediately, release start button, allow battery to rest for a moment and then try again. Never hold start button depressed for more than 2 or 3 seconds at a time. (Models M and U: Starter button is on engine switch. Center position is RUN. Press switch handle to left for start when released, it will spring back to RUN position.)

d. If the battery is not sufficiently charged to start the engine, leave all controls set as indicated, and crank the engine. *CAUTION: Place thumb on same side of crank handle as fingers and pull up sharply*

one-half turn. Never push down. A second person should operate the choke control during the cranking.

3. After engine starts and is warm, push throttle in slowly all the way. The governor will then take over.

Note: Since a gasoline engine will start more easily when prewarmed, it is suggested that, in the winter, cooling system water be heated almost to the boiling point before it is poured into the radiator.

4. In stopping the engine, remove electric load by opening main circuit breaker in the control panel, allowing the engine to run unloaded for 3 to 5 minutes. If the set has been operating under near full load conditions for an extended time, the water temperature will probably be near the maximum point. During this unloaded period, the water temperature should fall to 170°–180° F.

5. Stop the engine as follows:

Models M and U: Return the engine switch to STOP position.

Models K and B: Push magneto switch in.

Model J: Return ignition switch to STOP position.

6. Close fuel line shutoff valve.

7. If in winter months the temperature drops below 32° F., drain the radiator or put blankets over it to help protect it from freezing if the engine is stopped for more than 1 hour.

D. NORMAL OPERATION

1. When the engine is warming to operating temperature, check the a.c. voltmeter and adjust the voltage to 120 volts as follows:

- a. Models K, M, and U: Change the position of the voltage regulator control switch to ON (automatic) and adjust the voltage with the control knob adjacent to it to 120 volts on a.c. voltmeter. If the voltage fails to build up to 120, or if after application of load there is excessive voltage fluctuation, adjust the manual rheostat to compensate. Manual rheostat adjustments are made with the regulator selector switch in the

OFF or MANUAL position and the voltage regulator control adjustments are made with the selector switch in the automatic position.

b. Models J and B: Adjust the voltage regulator control knob until the voltmeter reads 120 volts.

2. Recheck the distribution system to be sure all branch circuits are in the OFF position.

3. Close the main circuit breaker on the generator control panel. *CAUTION: When this breaker is closed, the power output terminals are "hot" and it is possible to receive a fatal electric shock from them. Extreme care is required, especially for models J and B.*

4. Connect the various items of electrically operated hospital equipment as required. Each equipment cord is plugged in turn into its circuit. In this way, the load will be applied gradually to the generator.

Note: Do not connect all equipment and then energize the system by closing the main circuit breaker. This will apply too much load too suddenly and may damage the generator.

5. Recheck the a.c. voltmeter and adjust the voltage as necessary.

6. Check the balance of the load with the a.c. ammeter and its associated switch. All three positions of the switch should show approximately the same reading within plus or minus 20 percent. If not, hospital equipment loads should be changed from phase to phase by changing the extension cords from one distribution circuit to another. A little experimenting will be necessary to balance the load properly. *CAUTION: The a.c. ammeter should never show more than 42 amperes on any phase. Beyond this point, the generator will be overloaded on that phase and damage may result.*

7. The total load of all hospital equipment in these hospitals is approximately 3 kw. (fig. 2). The X-ray equipment is powered from its own generator. If this load is properly balanced, no phase should carry more than about 10 amperes at anytime. This will leave 25 amperes or more per phase for additional equipment, lighting, etc., as may be required. If any 3-phase motors are in operation, check rotation to see that they are going in the proper direction. If they are not, go back to the generator control panel, open the main breaker, and exchange any two of the three phase connections. Do not disturb the neutral connection.

8. Always check the frequency meter on the control panel. This should indicate a maximum of 62 cycles under no-load and a minimum of 60 cycles

Model 53 through 57 CDEH's

Electrically Operated Hospital Equipment

Item	C.D. No.	Voltage	Phase	Watts	Quantity	Total load (watts)
Surgical stand light ¹	V-412	120	1	150	4	600
Suction and pressure apparatus.	V-410	120	1	½ hp.	2	1,020
Water pump.	III-24	120	1	¾ hp.	1	1,500
Total power required.						3,120 (3.12 kw.)

¹ The quantity of surgical stand lights varies with the CDEH's: Model 53: four, Model 54: three, Model 55: nine, Model 56: three, Model 57: six.

The following equipment should be powered by the 2.5-kw., 120-volt generator provided.

Item	C.D. No	Voltage	Phase	Watts	Quantity	Total load (watts)
X-ray apparatus.	V-313	120	1	1,500	1	1,500
Film processing machine ¹	V-311	120	1	300	1	300

¹ The film processing machine can be powered by the 15-kw. generator.

Figure 2

under full load. If the meter shows operation outside of this range by more than one-half cycle, the speed control governor requires adjustment. For this operation, refer to the manufacturer's manual packed with the machine.

9. Water temperature in the cooling system should be maintained between 160° and 210° F. Check the water temperature gauge occasionally to be sure engine is operating within this range. Models M and U have an automatic safety device on the gauge which will stop the engine if excessive water temperature develops. Temperature may be regulated to some extent by the number of side panels in place or removed. *CAUTION: Always have at least one side panel removed, even in the coldest weather, to insure proper air passage through the radiator.*

10. The engine should not be operated if oil pressure is below 20 pounds per square inch. Check the oil pressure gauge occasionally to be sure engine is operating within this range.

Models M and U have automatic safety device on the gauge which will stop the engine if low oil pressure develops.

Models K, J, and B should be checked for oil and water every 5 hours of running time when shut down for refueling.

11. Models M and U are equipped with synchronizing lights. *CAUTION: Do not attempt to synchronize this type of generator either with another generator or with the commercial power source. Disregard these lights.*

E. FUEL SUPPLY

1. The fuel tank has a capacity of 15 to 20 gallons, sufficient for approximately 5 hours operation at full load. At less than full load, the operating time is extended.

2. The grade of gasoline is not important. The engine is designed to operate on any clean gasoline having an octane rating of 80 or higher. Clear or leaded gasoline can be used.

3. Determining the source of gasoline is an essential part of the predisaster plan.

4. In case of emergency, it is highly possible that a failure of commercial electrical power will render gasoline station fuel pumps inoperative. In such an event, a manual fuel pump with sufficient hose to reach down into the storage tank can be used to pump fuel from the tank to drums or other containers for transportation to the CDEH operating site. Frequently, the fill pipes of such underground storage tanks have one or more sharp bends which will make it difficult to insert a suction hose. In such cases, insert the hose through the tank vent pipe.

5. On all engines, except model B, there is provision for connection of an auxiliary fuel tank. In model J, this consists of a plugged tap into the cover of the fuel sight glass. This plug can be removed and replaced with a short section of metal pipe which has a shutoff valve and an adapter for a fuel suction hose. These items are not furnished and must be procured locally. In models K, M, and U, the fuel sight glass is equipped with an auxiliary shutoff valve and pressure connector for copper tubing. A 55-gallon drum makes a convenient auxiliary fuel tank. Whatever type of vessel is used, it should be carefully covered to keep contaminants out and should be protected against the possibility of fire. Warning signs should be installed. (See p. 57.)

Note: Reserve gasoline should be stored at least 50 feet from both the generator and hospital building and should be properly labeled.

F. SERVICING

1. Air Filter

Once each week or oftener if the area is dusty, remove the air filter, clean it carefully, and put in new oil. Directions on the filter should be followed carefully.

2. Lubrication and Oil Filter

The oil level in the crankcase should be checked daily. If it is low add additional oil. Do not overfill.

After the first 50 hours of operation, drain the crankcase, replace the oil filter with the spare packed with the unit and refill the crankcase with 4½ quarts of SAE 10W-30 oil.

After the initial oil and filter change, change the oil after each 100 hours of operation and the filter at least every 200 hours or more frequently if the oil appears unusually dirty. Place a few drops of engine oil on moving parts of linkage and other function points each time oil is changed. *CAUTION: Never flush the crankcase with kerosene.*

Also, after every 50 hours of operation add a few drops of oil to the oil cups on the engine starter and the d.c. generator for the engine battery. (Models K, J, and B: the starter has no provision for such oiling because bearings are permanently lubricated.)

Note: The above recommendations on lubrication are considered the best practice for prolonging the life of the generator. Under certain emergency conditions, however, it may not be possible to follow these procedures.

3. Cooling System

The cooling system requires approximately 15 quarts of water: 5 in the water jacket of the engine and 10 in the radiator.

In very cold weather, it may be necessary to close up at least part of the side openings of the engine and generator housing in order to keep the coolant temperature at the proper level.

In freezing weather, if the engine is to be stopped for periods exceeding an hour and antifreeze has not been installed, it will be necessary either to drain the cooling system or to add an antifreeze. Alcohol or ethylene glycol antifreeze can be used. Recommended quantities are shown in fig. 3.

Type of antifreeze	Minimum temperature expected					
	10° F.		- 10° F.		- 30° F.	
	Anti-freeze	Water	Anti-freeze	Water	Anti-freeze	Water
	Quarts	Quarts	Quarts	Quarts	Quarts	Quarts
Ethylene glycol.....	4	11	6	9	7½	7½
Alcohol (methyl).....	3½	11½	5½	9½	7½	7½
Alcohol (ethyl).....	4½	10½	6½	8½	9	6

Figure 3

Note: The alcohols and alcohol compounds evaporate easily. If a hydrometer is available, it should be used frequently to check the effectiveness of the coolant. If a hydrometer is not available use the ethylene glycol type of antifreeze.

4. Battery

The battery packed with the set may not start the engine initially. After a relatively short running period, however, the battery should be sufficiently charged to start the engine. In case the battery has deteriorated and will not charge, obtain a replacement battery. In the meantime, leave the dead battery in place and connected. If it is removed, the 6-volt d.c. generator may be damaged. Check the battery for fluid, especially during the first hours of operation. When the battery fluid is low in a particular cell fill the cell to the proper level using clean water. Distilled water is not required. Tap water can be used if it is not excessively hard. If the local water is cloudy, allow some to stand in a clean container for at least 24 hours, then fill the battery to the proper level, using the water from the upper half of the container. Dirty water can be filtered through a cloth to remove particles which might damage the battery.

5. A.C. Generator

The only regular service required is that the generator be kept clean and protected from rain or other dampness.

Bearings are permanently lubricated and should be adequate for up to 4,000 hours of operation. Greatest wear will occur at the sliprings. Care must be taken to keep this area clean and dry. Inspect the sliprings and brushes whenever the set is shut down, and clean as required in accordance with the manufacturer's manual. Because of their high flash point, stoddard solvents or alkaline solutions are preferable for cleaning. If these products are not available, gasoline can be used. If gasoline is used, be sure it has evaporated completely before the unit is restarted or an explosion could result.

THE 2.5-KILOWATT GENERATOR

A. GENERAL DESCRIPTION

There are two models of the 2.5-kw. generator in the Model 53 through 57 Civil Defense Emergency Hospitals:

<i>Generator Nos.</i>	<i>Model</i>
Fairbanks, Morse & Co., 25PX-36 (Contracts WA-O-43884, WA-O-54490 and FNW-F-1629-2/3.....)	F
Hamco, Inc., GA-C-250-GSA/19 (Contracts FNW-F-6281/3.....)	H

The 2.5-kw. generator sets covered by this manual are similar in nature and many of the instructions apply to each. Where differences exist, the text contains special notations which refer by the above model letters to the specific model to which the instructions apply. The model can be determined from the contract number which is stamped on the outside of the crate. The generator number is also found on the name plate affixed to each generator.

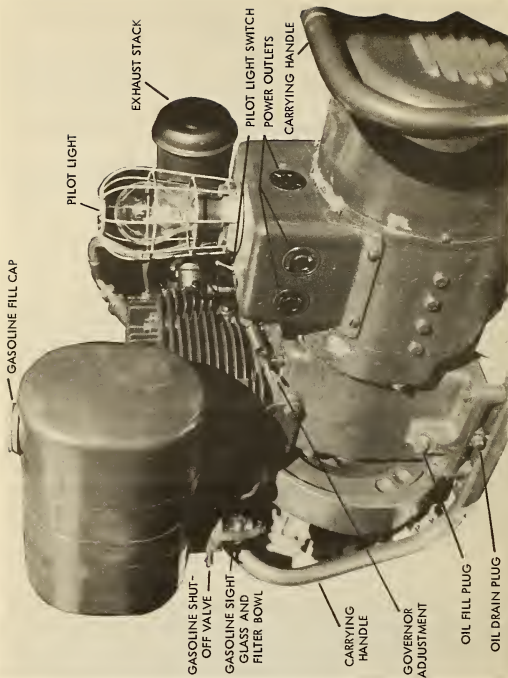
The 2.5-kw. generator is a 2-pole machine, having 60-cycle, 120-volt output at 3,600 r.p.m. It is single-phase, 2-wire.

1. Engine

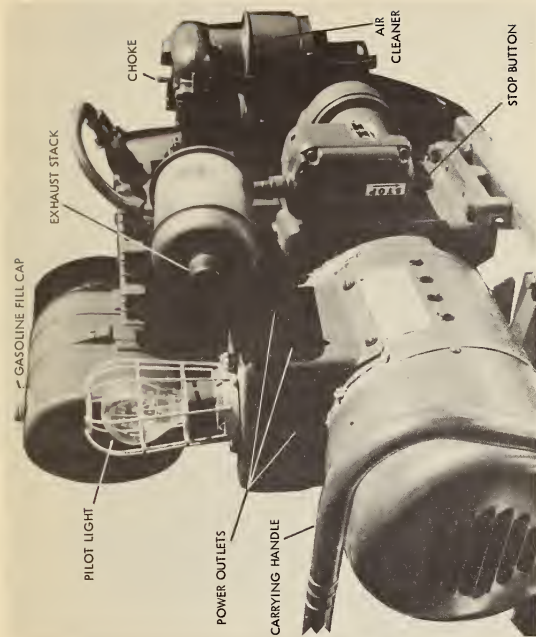
Gasoline, air-cooled, four-cycle, direct-coupled to generator. At sea level, model F is rated at 6.8 horsepower and model H at 7.0 horsepower. A governor is provided to maintain proper speed. The engine is of the conventional I-head type with single-barrel carburetor and magneto. It is started with a cranking rope attached to generator frame.

2. Housing

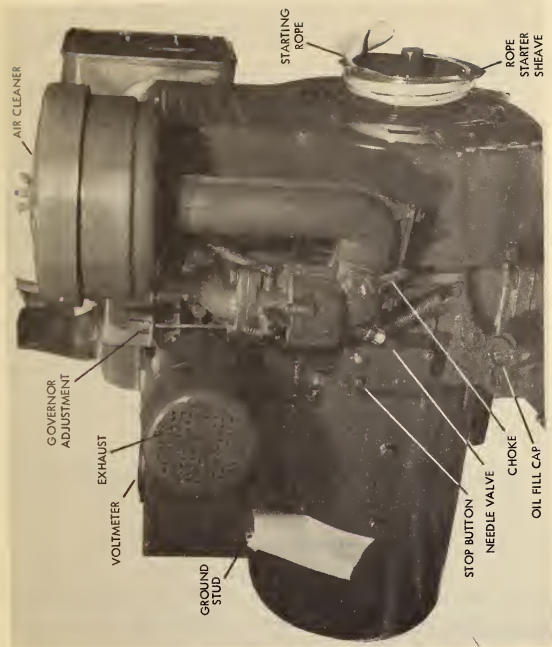
The engine and generator are mounted together on a frame arranged for easy portability. There is no housing, but individual parts are weather-protected except for the electrical receptacles.



Fairbanks, Morse & Co., 25 PX-36
MODEL F, 2.5-KW., Left Side



MODEL F, 2.5-KW., Right Side



MODEL H, 2.5-KW., Right Side

3. Accessories

Accessories packed with each generator model are listed on page 56.

4. Identification of Components

See illustrations on preceding pages for names and locations of principal controls and components of each model.

B. PREPARATION FOR USE

1. Uncrating and Moving to Position

This can be done easily by two men. Set the unit in a level place where there is unrestricted ventilation. *CAUTION: Set up the unit outdoors when possible. Never run it indoors without venting the exhaust. Death from carbon monoxide poisoning can result from improper ventilation of exhaust gases.*

2. Use

This generator is intended to supply 120-volt power to the X-ray apparatus and film processing machine, and should, therefore, be located as near these units as possible.

3. Manuals and Accessories

Keep the starting rope with the unit. File the manuals in a convenient place for easy reference.

4. Engine

a. Fill crankcase, using 10W-30 oil or its equivalent. Model F takes about 2 pints, model H about 3 pints. Both should be filled to the top of the filler plughole.

b. Fill air cleaner, using the same type of oil as for the crankcase. Take off the wingnut or retaining bale and remove the filter element. Fill the bowl up to the oil-level line, which will require about ½ pint. Replace the element and the wingnut or bale.

c. Fill gasoline tank. Use a good grade of regular gasoline.

Note: If premium gasoline is used in warm weather, it may be necessary to adjust the spark advance. (See the manufacturer's manual.)

d. If the cord packed with the X-ray is too short to reach from the generator to the X-ray unit, an extension cord can be used. In case of rain or snow, provide a protective cover over the electrical outlets on the generator. A piece of plastic held in place with a string is sufficient.

e. Provide a ground for the common frame of the engine-generator.

C. STARTING AND STOPPING ENGINE

1. Open fuel valve.

2. Close choke, turning lever counterclockwise.

3. Place knot of starting rope in slot of starting sheave with knot on the outside and wrap rope clockwise around sheave (about two turns). Pull rope slowly until compression of engine is felt. Then pull rope sharply all the way.

4. If engine starts, model F choke will open automatically; model H choke will not, and should be opened gradually as engine warms.

5. If engine does not start, check choke of model F and reset if it has opened. With model H, open choke one-eighth.

6. Rewind rope in starting sheave. Pull slowly until compression is felt, then pull sharply.

7. Repeat steps 5 and 6 until engine starts. If engine does not start, and gasoline begins to drip from carburetor, open choke all the way, wait a minute or two and repeat step 6.

8. When engine starts, open choke of model H gradually until engine runs smoothly with choke wide open.

Note: The engine speed can be increased or decreased to secure proper voltage or cycles by means of a square nut connected to a governor linkage rod which is located beside the engine head. Clockwise turns increase engine speed and counterclockwise turns decrease it.

9. To stop engine, press down STOP button and hold until engine comes to rest.

10. When engine has stopped, close fuel line valve.

D. NORMAL OPERATION

1. The 2.5-kw. generator is intended to power the X-ray apparatus and film processing machine only and should be reserved for this purpose.
2. When the engine has warmed and is running smoothly, plug the extension cords for the X-ray apparatus and film processing machine into the outlets provided on the generator.
3. Model F generator has 2-pole Hubbell twist-lock receptacles and cord ends. Model H generator has 3-pole Hubbell twist-lock receptacles and cord ends.
4. To furnish power from these generators to any equipment with 2-parallel-blade plugs:

Model F: Replace the 2-parallel-blade plug with a 2-pole twist-lock plug. *CAUTION: If equipment has a green or ground lead, connect this lead to the generator frame, not to the plug.*

Model H: Replace the 2-parallel-blade plug with a 3-pole twist-lock plug. *CAUTION: If equipment has a green or ground lead, connect it to the ground element (which is shaped differently from the two line elements) of the twist-lock plug.*

5. If it is necessary to provide an extension cord from the generator to the X-ray equipment cord, a single extension cord of at least 14 gauge should be used. If the extension cord has a conventional 2-pole male plug, this plug must be replaced by one of the twist-lock male plugs furnished with the generator.

E. FUEL SUPPLY

1. The capacity of the fuel tank is approximately $1\frac{3}{4}$ gallons, which should permit the engine to operate at full load for about 2 hours.
2. Either regular or premium gasoline can be used. *CAUTION: Do not add oil to the gasoline.*
3. The fuel supply can be obtained by the same means as suggested for the 15-kw. generator. See page 26.

Note: When filling the fuel tank, extreme care must be taken to prevent spilling gasoline on hot portions of the engine. A small amount of fuel thus spilled can cause an explosive mixture and the heat of the exhaust manifold may be sufficient to ignite it.

F. SERVICING

1. Air Filter

Once each week, or oftener if the area is dusty, remove the air filter, clean it carefully, and put in new oil. Check for dirt accumulation as often as possible during the first few days. Experience will soon indicate the amount of time between cleanings for a given installation.

2. Lubrication

Drain the crankcase and refill it after each 50 hours of operation. Use a good grade of 10W-30 motor oil and fill to the filler opening. Two pints are required for model F, 3 pints for model H. Drain the oil while the engine is still warm. Place a few drops of engine oil on moving parts of linkage and other function points each time oil is changed.

Check the glass strainer bowl at least once daily. If sediment is noted, stop the engine and turn off the fuel valve, remove and clean the bowl and strainer. When replacing, be sure that the gasket is seated properly to prevent possible leakage. There is no prescribed interval for this operation because it depends upon the amount of dirt in the gasoline.

THE 10-KILOWATT GENERATOR

A. GENERAL DESCRIPTION

Two identical 10-kw. generators are included in each Model 62 CDEH.

<i>Generator No.</i>	<i>Model</i>
Hol-Gar Mfg. Corp., model GS-107-AC.....	G

The 10-kw. generator is capable of 10-kw. output, 60 cycles at 1,800 r.p.m., at 0.8 power factor. It is of the single-bearing, self-excited type.

The generator as packed is wired for 120/208-volt, 3-phase, 4-wire WYE operation. Other voltages which can be obtained by changing the terminal board patch panel are:

120-volt, 1-phase, 2-wire.

120/240-volt, 1-phase, 3-wire.

240/416 volt, 3-phase, 4-wire.

240-volt, 3-phase, 3-wire.

1. Engine

Gasoline, air-cooled, 4-cylinder, 4-cycle of approximately 30.5 horsepower, directly connected to the generator. Engine is equipped with an automatic speed control governor to maintain 1,800 r.p.m. Starting is by hand crank only with ignition provided by a built-in magneto. There is no battery.

2. Housing

The engine and generator are of drip-proof construction with the exception of the instrument panel. There is no overall housing.

3. Accessories

Accessories packed with the 10-kw. generator are listed on page 56.

4. Identification of Components

See illustrations on the following pages for names and locations of principal controls and components.

B. PREPARATION FOR USE

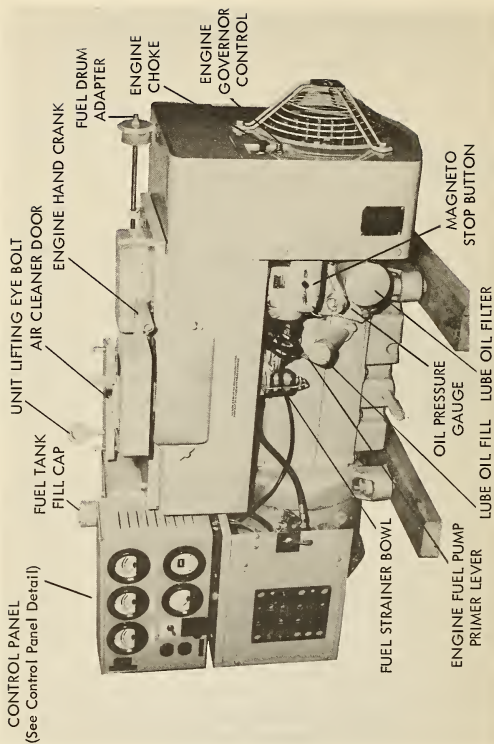
1. Moving to Position

Select convenient operating positions within 80 or 90 feet of the load center which each unit serves.

Note: One generator provides sufficient capacity for all hospital electrical loads except the 8,000-watt sterilizer and lighting. The second generator should be used for lighting or other uses not exceeding its capacity. The 8,000-watt sterilizer is not to be heated by either generator. It should be heated by the gasoline burner. Its electric heating coils are intended for use only with commercial electric power. Only if the gasoline burner fails and there is no commercial power should it be necessary to power this sterilizer from the generator.

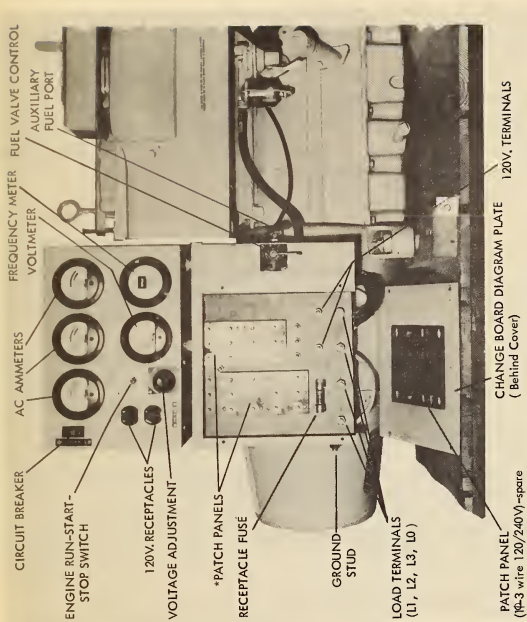
Unless special provisions for external exhausting have been made, the generators should be located outdoors to ensure proper ventilation and dispersal of exhaust gases. For each generator, select a level, solid, well-drained location. Good drainage will lessen the electric shock hazard and prevent water damage.

Each unit weighs approximately 1,000 pounds crated. Because there is no protective housing for the generator, it is best to move it into position before uncrating. This can be done easily with a forklift if one is available. Otherwise, pass a rope sling around the crate *near the bottom* and pull or winch the unit into position. To facilitate moving over unpaved surfaces it may be necessary to obtain boards or sheets of plywood at least 5/8-inch thick in order to provide a surface over which the unit can be drawn. Because of the skid design, pipe rolling is not possible without modification of the skid. If a crane is available, the crate can be removed and the eyebolt assembly secured in place. *Do not remove the wooden skid. It is the mounting platform of the unit.*



Hol-Gar Mfg. Corp., CS-107-AC

MODEL G, 10-KW. GENERATOR



* Patch Panels pictured in 120V 102W position. Unit actually shipped with panels in 120/208V 304W position.

MODEL G, 10-KW., Control Panel

2. Uncrating

- a. Remove the protective wooden crate by first unbolting it from the skid and then lifting it off.
- b. Remove the accessories packed outside the moisture-proof envelope enclosing the unit, then remove the envelope and the moisture-proof bags within it. Try to keep the envelope from tearing as it can be used later for protective covering.

If time and materials are available, it may be advisable to use the crate to make a temporary roof over the unit to protect it from direct weather. The moisture-proof envelope can then be nailed over the temporary roof to keep rain from leaking through.

There are two copies of the manufacturer's manual packed with each generator. Remove one to a safe place such as the storeroom. Keep the other with the unit for reference.

3. Engine

- a. Remove oil dipstick to allow a release vent for air while the oil is being poured. Fill the crankcase with 6 quarts of 10W-30 motor oil or its equivalent.
- b. Remove the foam carburetor air filter element from its wire mesh retainer, saturate it with oil of the same type used in the crankcase, and squeeze it as dry as possible. Replace it over the retainer in its original position.
- c. Fill the fuel tank with regular-grade gasoline. Check to be sure there is no dirt or water in the fuel.
- d. Set the muffler in place. No tools are required to make this attachment.

4. Generator

- a. Remove the ground rod from its packing position and drive it into the ground near the generator. Select a point where the ground seems moist and will provide the best connection. Run the ground wire to the generator and connect it to the ground clamp provided on the frame.

Note: If there is a water pipe (not fuel or gas) near the generator it will probably make a better ground and should be used instead of the ground rod provided. If this is done, be sure to make a strong, tight connection that will not come loose from the pipe.

b. It is possible to change the type of voltage available at the power output terminals. Remove the cover enclosing these terminals and examine the patch panels, noting their position. There should be two panels in place on the upper portion of the terminal board and a third, larger panel in a storage position on the outside of the cover plate. The two small panels should be in the highest position possible, with no studs showing above either. In this position, the lower terminals, marked L_0 (neutral), L_1 , L_2 , and L_3 , (phase terminals), will provide 120/208-volt, 3-phase, 4-wire service with a maximum capacity of 15 kw. at 0.8 power factor. It is expected that this will be the most often used class of service and therefore the generators are packed in this manner.

c. If another class of service is desired, the following are available:

Class of Service	Maximum Output Capacity at 0.8 P.F.
	<i>Kilowatts</i>
120/240-volt, 1-phase, 3-wire	10
120-volt, 1-phase, 2-wire	10
240-volt, 3-phase, 3-wire	15
240/416-volt, 3-phase, 4-wire	15

CAUTION: Do not attempt to change class of service with engine running, even with the breaker off.

Any of these additional classes may be selected by setting the proper patch panels in the proper positions and securing them with the nuts provided. The selected voltage class will then be available at the output terminals L_0 , L_1 , L_2 , and L_3 . See the manufacturer's manual, page 14, for sketches of panels and their positions to obtain the desired voltage.

d. Use four 100-foot lengths of AWG No. 6 wire (or larger) , for feeder conductors from each generator to the distribution system it will supply in the hospital. Connect one of the feeder conductors to the neutral terminal on the generator terminal panel (terminal L_0) and to the neutral of the distribution system. Then connect the other three feeder conductors to terminals L_1 , L_2 , and L_3 in any order. Unroll them and connect to the phase terminals of the distribution system.

e. Protect the feeder wires from damage by elevating them and securing them to trees, walls, etc. Keep them off floors and the ground.
CAUTION: These wires may not be completely waterproof and allow-

ing them to remain on the ground or floor where they may be subject to damage or water could be dangerous to personnel.

5. Checking

- a. Check both the engine and generator to be sure there are no damaged or loose parts.
- b. Make sure electrical connections are tight and clear.
- c. Make sure all controls are in the OFF position.
- d. Be sure the unit and its skid are firmly seated and will not rock when started.

C. STARTING AND STOPPING ENGINE

1. Open fuel valve and prime carburetor by operating fuel pump priming lever about 15 strokes. Be sure priming lever is left in the down (inward) position where it is disengaged.
2. Set engine switch in START position.
3. Adjust hand choke to suit weather conditions. In very cold weather, pull it out most of the way; in very warm weather, pull it out only a little. Trial and error will determine the optimum setting.
4. Engage the crank handle at the "7 o'clock" position and pull it up sharply to the "12 o'clock" position. Two or three such cranks should start the engine.
5. Turn engine switch to the RUN position. *This is an important step.*
6. Check oil pressure. It must be at least 20 pounds on the gauge and will normally be between 30 and 35 pounds per square inch.
7. If there is no oil pressure upon first starting engine, stop engine immediately and recheck oil level. If oil level is satisfactory, proceed as follows:
 - a. Start other generator, ascertain that oil pressure gauge is functioning and then shut down the engine.

b. Remove the good oil gauge and place it on the doubtful generator in place of its own gauge.

c. Restart doubtful generator and check gauge. If pressure is indicated original gauge is defective but should be used to plug the gauge hole on the other machine until repair can be accomplished. If no pressure is indicated on the good gauge, refer to manufacturer's manual. It may be necessary to obtain the services of a mechanic.

8. As engine warms, push choke control in slowly until engine is running smoothly with choke all the way in.

9. There is a preservative compound coating the cylinders for storage. When the engine first starts, this will produce a dense black exhaust smoke.

10. When stopping the engine, remove electric load by turning load switch to OFF position. Allow engine to idle for 3 to 5 minutes, place engine switch in STOP position, and turn fuel valve to OFF position.

D. NORMAL OPERATION

1. When the engine is first started, and while it is warming up, check the a.c. voltmeter and adjust the voltage. The voltmeter indicates a maximum of 150 volts and is connected to read from phase to neutral. Thus the voltage that will appear across the terminals of a receptacle in the system may be read directly for the following connections:

120/208-volt, 3-phase, 4-wire.

120/240-volt, 1-phase, 3-wire.

120-volt, 1-phase, 2-wire.

The voltmeter reading must be multiplied by 2 for the following connections:

240-volt, 3-phase, 3-wire.

240/416-volt, 3-phase, 4-wire.

Note: The manufacturer's manual gives multiplying factors which are different from those indicated here. They will give phase-to-phase voltage and will rarely be needed since all but one item of hospital equipment operates on 120 volts.

2. Recheck the distribution system to be sure that the feeder conductors are properly connected and that hospital equipment, lighting, etc., is *not* connected. Replace cover over the terminal board of the generator.

3. Close the load switch (circuit breaker) on the control panel.

4. Connect the various items of electrically powered equipment which are to use the output from this generator. As each cord is plugged in, turn on its circuit at the distribution point. In this way, the load will be applied gradually to the generator. When all have been connected, readjust voltage to 120 volts.

Note: Do not connect the entire load and then energize it by closing the load switch on the generator control panel. This will apply too much load too quickly and may damage the generator.

5. Recheck the a.c. voltmeter and adjust the voltage accordingly.

6. Always check the balance of the load by referring to the 3 ammeters on the control panel. They should all read approximately the same and the pointer should be in the green area of each scale.

Note: There are different scales for single and 3-phase connection of the output. Be sure to refer to the proper scale.

If one or more ammeters show a reading above the green area of the scale, or if the meters do not indicate the same reading (plus or minus 20 percent), change some of the equipment or lighting loads from one phase to another until a proper balance is achieved and no phase is overloaded.

7. The total load of all hospital equipment, not including the 8,000-watt sterilizer, is 9,180 watts (9.18 kw.) and a single generator is sufficient to serve it (fig. 4). All hospital equipment (except the sterilizer) requires 120-volt service. The electric heating coils of the sterilizer require 220-volt, single-phase service. The sterilizer should be heated by the gasoline burner if commercial electrical service is not available. Only if the gasoline burner fails and commercial power is absent should it be powered by one of the generators.

If any 3-phase motors are in operation, check rotation to see that they are going in the proper direction. If they are not, go back to the generator control panel, open the main breaker, and exchange any two of the three phase connections. Do not disturb the neutral connection.

8. Check the frequency meter on the control panel. This should indicate a maximum of 62 cycles per second under no-load and a minimum of 60 cycles per second under full-load conditions. If the meter shows operation outside of this range by greater than one-half cycle per second, the speed control governor of the engine requires adjustment. See the manufacturer's manual for necessary instructions.

Model 62 CDEH

Electrically Operated Hospital Equipment

Item	Federal stock No.	Voltage	Phase	Watts	Quantity	Load (watts)
Surgical light.....	6530-706-6205	120	1	150	3	450
Surgical light.....	6530-706-6475	120	1	150	3	450
Sterilizer.....	6530-000-0010	120	1	1,600	1	1,600
Light, head.....	6515-000-0124	120	1	5	4	20
Otoscope.....	6515-000-0233	120	1	5	6	30
Sigmoidoscope.....	6515-000-0244	120	1	5	1	5
Suction apparatus.....	6515-299-8337	120	1	¼ hp.	6	3,060
Dental light.....	6520-538-7100	120	1	100	1	100
Centrifuge.....	6640-000-0103	120	1	150	1	150
Microscope illuminator.....	6650-000-0201	120	1	15	1	15
Film processing machine.....	6525-823-8127	120	1	300	1	300
X-ray apparatus.....	6525-612-4710	120	1	1,500	1	1,500
Water pump.....	4320-000-0001	120	1	¾ hp.	1	1,500
Total power required.....						9,180 (9.18 kw.)

The following item should be gasoline-fired unless commercial electric service is available:

Item	Federal stock No.	Voltage	Phase	Watts	Quantity	Load (watts)
Sterilizer.....	6530-000-0011	220	1	8,000	1	8,000

Figure 4

9. Check the oil pressure gauge occasionally. Oil pressure should be maintained at between 30 and 35 pounds during normal operation. It should never fall below 20, although it will be higher at starting and until the engine reaches operating temperature. There is an automatic device provided which will stop the engine if the oil pressure drops dangerously low.

Note: NEVER attempt to operate the two generators in parallel (serving the same load simultaneously) or to parallel either or both with other sources of electrical power such as a commercial source. These units are not designed for such use and will suffer great damage if so connected.

E. FUEL SUPPLY

1. The fuel tank on the unit has a full capacity of 5.3 gallons, which is sufficient for approximately 2 hours of operation at full load. At less than full load, generator will operate for a longer period.

2. Grade of gasoline is not important. The engine is designed to operate on any clean leaded or unleaded gasoline with an octaine rating of 80 or higher.

3. Determining the source of gasoline is an essential part of the predisaster plan. See section 4, page 26, for method of obtaining gasoline when gasoline station pumps are inoperative.

4. There is provision for connection of an auxiliary fuel tank. This consists of a dip-tube, strainer and hose. Connect the hose where indicated, insert the dip-tube into the auxiliary supply tank or drum, and set the fuel valve at the AUXILIARY position.

A 55-gallon drum makes a convenient auxiliary fuel tank. Whatever type of container is used, it should be carefully covered to keep contaminants out and should be protected against the possibility of fire. Warning signs should be installed. (See p. 57.)

Note: Reserve gasoline should be stored at least 50 feet from both the generator and hospital building and should be properly labeled.

F. SERVICING

1. Air Filter

Once each 100 hours, or oftener if area is dusty, remove the sponge rubber air filter, clean with gasoline and squeeze as dry as possible. Saturate it with 10W-30 crankcase oil, squeeze out excess oil, and replace filter in filter housing.

2. Lubrication

Check crankcase oil level every 8 hours, and change oil every 100 hours. Change oil filter element every 500 hours. When changing crankcase oil, drain old oil only when engine is warm to assure complete draining. Use a good grade of 10W-30 motor oil.

Place a few drops of engine oil on moving parts of linkage and other friction points each time oil is changed.

3. Gasoline Strainer

Check the glass fuel strainer bowl at least once daily. If sediment is noted, stop the engine and turn off the fuel valve, remove and clean the

bowl and strainer. When replacing it be sure that the gasket is sealed properly to prevent possible leakage. There is no prescribed interval for this operation as it depends upon the amount of dirt in the gasoline.

4. Cooling System

This engine is air cooled and therefore must never be operated unless engine shrouds are securely in place. Shrouds are held in place by bolts. Check each 8 hours to be sure that bolts are tight and that air flow occurs without excessive leaks around shrouds.

Note: See manufacturer's manual for detailed instructions for 8-, 100-, 200-, 500- and 1,000-hour service.

WIRING OF PRESELECTED BUILDINGS

A. GENERAL CONSIDERATIONS

Wiring the building where the CDEH is to be used is extremely important. Without an adequate distribution system to get the electrical power from the generator to the various items of hospital equipment, the lighting system, etc., the CDEH could become electrically inoperative and fail to fulfill its mission.

The most desirable approach is to utilize the existing wiring in the building preselected for use as the CDEH operating site. This method permits ready transfer to commercial power if it should later be restored. In order to make the best use of an existing wiring system, the following points should first be considered:

1. Are there enough existing receptacles of the right type conveniently distributed for connection of hospital equipment?
2. Is it possible to disconnect existing heavy loads in the hospital area so that the generator will not be inadvertently overloaded with nonessential connected equipment?
3. Is the wiring system of the building arranged so that the portion of it serving the hospital can be isolated and fed separately from the emergency generator?
4. Is the output of the generator (120/208-volt, 3-phase, 4-wire, 60 cycle) compatible with the class of service for which the distribution system was designed? If not, can it be used, even at reduced efficiency?

B. RECEPTACLES

The Models 53 through 57 CDEH's require relatively few outlets. These are needed in three service areas: the laboratory, the examining

room, and the operating room. (As previously noted, the X-ray is powered by its own small generator and a single extension cord run through a convenient window can connect it to this generator.) It is important that the outlets in the various hospital areas be served from a sufficient number of branch circuits to avoid shutting down several areas if a defect occurs in one circuit.

The Model 62 CDEH requires approximately thirty 120-volt outlets distributed throughout the various hospital service areas. Here, too, it is important that these outlets be distributed among several branch circuits.

C. AVOIDANCE OF OVERLOAD

The total hospital equipment load for the Models 53 through 57 CDEH's is only a little over 3 kw. This means that there is approximately 12 kw. spare capacity in the generator for lighting or other miscellaneous uses. A careful calculation of the existing loads connected to that portion of the wiring system which will be energized by the generator should be made. Nonessential equipment such as large fans, boilers, electric cooking devices, superfluous lights, etc., should be disconnected or locked out. Removing all or a portion of the light bulbs from fixtures (which will also give a supply of spare bulbs) and disconnecting some branch circuits can also help prevent overloading the generator.

In the Model 62 CDEH, the total hospital equipment load is approximately 9.18 kw. (not including the 8,000 w. sterilizer which should not be powered from a generator). One generator is quite capable of handling this load with some capacity left over. The amount of remaining capacity will depend upon whether a single-phase or a 3-phase connection is used. This reserve may be used for lighting in the hospital area which is served by that portion of the building distribution system to which the generator is connected. As with the other generators, care must be taken to eliminate unnecessary loads such as large fans, cooking equipment, boilers, non-essential lights, and other items not critically needed for operation of the hospital.

D. ISOLATION OF PART OF THE SYSTEM

The existing system should be such that a portion can be isolated so that only that portion will be energized by the generator. If it is possible to isolate part of the system at the main distribution panel or main service point, it will probably be easier than if it is necessary to do this at a branch panelboard. Normal incoming service wires should be physi-

cally disconnected and their ends marked and taped for future reconnection. *CAUTION: While the generator is in use, the normal service wires should never be reconnected. To do so would seriously damage the generator in the event the commercial power were restored.* Also, leaving these wires disconnected will prevent accidental feed to parts of the existing system not needed for hospital use.

Note: *Although synchronizing lights are installed in models M and U, no attempt should ever be made to actually synchronize these generators to another source.*

In the Model 62 CDEH, the second generator is available for several possible uses. Among these are the operation of lighting, heating, or miscellaneous equipment and as standby for the first generator. If it is decided to operate both generators simultaneously, *they must be used on separate, unconnected portions of the building electrical system.* Under no circumstances may both generators be connected so that there is a possibility of their feeding a single system or load in parallel. *To do so would invariably damage one or both machines.*

E. CLASS OF SERVICE

In various parts of the country there are several different classes of electrical service. Some of the most common are as follows:

1. 120/208-volt, 3-phase, 4-wire

This class of service is quite common, particularly east of the Mississippi River. It is the class of service for which the generators are connected, as packed, and no difficulty should be experienced in using them on a wiring system with this class of service.

2. 230-volt, 3-phase, 3-wire with 1 side center-tapped to provide 115/230-volt, single-phase, 3-wire

This class is sometimes called the 4-wire delta service. It usually requires double metering, one meter for the 3-phase, 3-wire portion serving the large motors and heavy loads, and a second, single-phase, 3-wire portion serving lighting, receptacle and miscellaneous small loads within the building. It is the latter portion with which the CDEH is concerned. The common practice of double metering and employing two incoming services can simplify connecting to the proper portion of this system.

When one of the 15-kw. generators is connected to a portion of the single-phase distribution in a system of this class, one phase of the gen-

erator output will remain unconnected and the maximum capacity of the unit will be reduced to 8.7 kw. (58 percent of normal). The operator must take this into account when allowing for loads in addition to the hospital equipment. The generator may tend to overheat as its 8.7-kw. capacity is approached. Overheating should be watched for and, if it occurs, the load should be reduced.

In the model 62 CDEH, each of the two generators supplied can provide 120/240-volt, single-phase, 3-wire service with a capacity of 10 kw. Such service is compatible with the 115/230-volt portion of the existing system and the generator or generators, properly connected, should operate on this system without difficulty. *CAUTION: Extreme care must be taken to avoid simultaneous operation of the two generators to serve the same load or system.*

3. 120/240-volt, single-phase, 3-wire or 115/230-volt, single-phase, 3-wire

Either of these is rather common in smaller buildings. Each can be tied into and used in the same manner as recommended for the single-phase portion of the 4-wire delta class, discussed in paragraph E-2 above. Notice that capacity of the 15-kw. generator is then reduced.

4. 120-volt, single-phase, 2-wire

This class of service may be encountered occasionally in small buildings or warehouses or in barns with very small electrical loads. In case it is necessary to adapt to such a system, two phases of the 15-kw. generator will remain unconnected, and the capacity of the unit will be reduced to 5 kw. Precautions against overheating should be taken in this case also, and the generator should be watched closely while it is in operation.

If it is necessary to adapt the 10-kw. generator to such a system, the generator may be connected to provide this service with a maximum capacity of 10 kw. No difficulty should be encountered.

5. 277/480-volt, 3-phase, 4-wire or 265/460-volt, 3-phase, 4-wire

This is probably the most difficult class to which to connect the 15-kw. or 10-kw. generators for it will not adapt to the service voltage without the use of a special transformer, which may be difficult to obtain. In such a system, dry-type transformers are universally included to provide 120-volt service for incandescent lighting, receptacles, small motors, etc. Sometimes these transformers are connected to provide 120/208-volt, 3-phase, 4-wire service (in larger buildings), and sometimes they provide only 120/240-volt, single-phase, 3-wire service. In either case the generator should be applied only to a section of this low-voltage portion of the system

to serve the receptacles in the hospital area. In order to avoid possible problems from back-feed, the built-in transformer serving the selected portion should be disconnected.

Unfortunately, in such a building, the main lighting is usually of the fluorescent type operating at 277 volts and it cannot be energized by the 15-kw. or 10-kw. generators. It will therefore be necessary to provide for lighting from the generator by other means. If there are sufficient receptacles or a large enough number of branch circuits, it may be that floor or pinup lamps can be provided locally. Otherwise, a wiring harness, discussed below, may be necessary. Note that if the low-voltage system is of the single-phase, 3-wire type, the 15-kw. generator will have a reduced capacity and will be subject to overheating as discussed in section E-2 above.

F. WIRING HARNESS

A wiring harness is another way of utilizing the generator's output. It uses equipment which does not depend upon the existing wiring within the operating site building. A wiring harness consists of a branch panelboard which contains either fuses or circuit breakers for branch circuit protection and duplex receptacles, mounted either in or on the sides. It serves very well as a load center to which the various items of hospital equipment can be connected.

The panel board should contain from twelve to sixteen 15- or 20-ampere branches symmetrically connected across the three phases. Each branch will serve one of the duplex receptacles. The receptacles must be located so that they are accessible from outside the cabinet for plugging in the extension cords or the pigtails of equipment. The panelboard should be served from the generator by No. 6 feeders. An eyebolt should be attached to the top of the cabinet so that it can be hung on the wall easily.

Extension cords can be made up from material normally available locally. They must be capable of carrying the 120-volt service from the panelboard to hospital equipment and lighting as required for the individual site.

Specifications for wiring harness components

1. Main bussing within the panelboard should have a minimum rating of 50 amperes. Branches should be symmetrically connected so that an equal number are served by each phase.
2. The neutral bar should have the same capacity as the main bussing.

3. If it is difficult to find the necessary punches and tools for mounting the receptacles flush in the sides of the cabinet, it may be better to use surface-mounted utility boxes. It is suggested that they be secured by a chase nipple at one end of the bottom of the box and a screw at the other. This will provide a suitable method of passing the necessary wires from the cabinet to each box.

4. U-ground receptables, Type 5161 or equivalent, should be used, with the grounds tied to the cabinet and neutral bar of the panel. Since the neutral will be grounded at the generator, a sufficient bonding system will be provided.

5. Extension cords should be of AWG No. 16, three-wire type. They should be provided with U-ground caps and receptacles in order to extend the bonding and equipment grounding to the hospital equipment.

6. The power cable on some medical equipment is equipped with a 2-pole plug connector. To use this with a 3-wire receptacle, utilize a 3-wire, U-ground adapter and run an external ground wire to the equipment chassis. An alternate plan is to replace the 2-pole plug connector on the unit power cable with a 3-pole U-ground plug connector and run an external ground wire to the equipment chassis.

7. Additional cords with lamp sockets at intervals may be provided and strung as desired from the ceilings to provide lighting. If metallic shell lampholders are used, these cords should also be of the 3-wire type to provide an equipment ground to the lamp socket shell.

GENERATOR ACCESSORIES AND SUPPLIES

	15 kw.					2.5 kw.		10 kw.
	K	M	U	J	B	F	H	G
Hand crank.....	Incl....	Incl....	Incl....	Incl....	Incl....	(*)....	(*)....	Incl.
Starter rope.....	(*)....	(*)....	(*)....	(*)....	(*)....	Incl....	Incl....	(*)....
Spark plugs (spare set).....	Incl....	Incl....	Incl....	Incl....	Incl....	Add....	Add....	Incl.
Magneto points (spare set).....	Incl....	Incl....	Incl....	Incl....	Incl....	Add....	Add....	Add.
Commutator brush (spare set).....	Incl....	Incl....	Add....	Incl....	Incl....	Add....	Add....	Add.
Slipping brush (spare set).....	Incl....	Incl....	Add....	Incl....	Incl....	Add....	Add....	Incl.
Wrench set (Allen-type).....	Add....	Add....	Add....	Add....	Add....	(*)....	(*)....	Incl.
Lineman's pliers.....	Add....	Add....	Add....	Incl....	Add....	Add....	Add....	Incl.
Longnose pliers.....	Add....	Add....	Add....	Add....	Add....	Add....	Add....	Incl.
Screwdrivers.....	Add....	Add....	Add....	Incl....	Add....	Add....	Add....	Incl.
Spark plug wrench.....	Add....	Incl....	Incl....	Incl....	Add....	Add....	Add....	Add.
Line voltage indicator.....	Add....	Add....	Add....	Add....	Add....	Add....	Add....	Incl.
Volt-ammeter.....	Add....	Add....	Add....	Add....	Add....	Add....	Add....	Incl.
Fuses.....	Add....	Add....	Incl....	Add....	Add....	(*)....	(*)....	Incl.
Fire extinguisher.....	Incl....	Incl....	Incl....	Incl....	Incl....	Add....	Add....	Incl.
Ground rod and attachment cable.....	Add....	Add....	Add....	Add....	Add....	Add....	Add....	Incl.
4 rolls of No. 6 wire.....	Incl....	Incl....	Incl....	Incl....	Incl....	(*)....	(*)....	Add.
Eyebolt assembly.....	(*)....	(*)....	(*)....	(*)....	Add....	(*)....	(*)....	Incl.
2 copies manufacturer's manual.....	Incl....	Incl....	Incl....	Incl....	Incl....	Incl....	Incl....	Incl.
Fuel drum adapter with straining hose.....	Add....	Add....	Add....	Add....	Add....	(*)....	(*)....	Incl.
Gasoline.....	Add....	Add....	Add....	Add....	Add....	Add....	Add....	Add.
Oil filter ¹	Incl....	Incl....	Incl....	Incl....	(*)....	(*)....	(*)....	Incl.
Oil.....	Add....	Add....	Add....	Add....	Add....	Add....	Add....	Add.
Antifreeze.....	Add....	Add....	Add....	Add....	Add....	(*)....	(*)....	(*)....
Water.....	Add....	Add....	Add....	Add....	Add....	(*)....	(*)....	(*)....
Spare wire.....	Add....	Add....	Add....	Add....	Add....	Add....	Add....	Incl.
Extension cords.....	Add....	Add....	Add....	Add....	Add....	Add....	Add....	Incl.
Electrical tape.....	Add....	Add....	Add....	Add....	Add....	Add....	Add....	Incl.
Extra light bulbs and fixture sockets.....	Add....	Add....	Add....	Add....	Add....	Add....	Add....	Incl.
Glass funnel (CDEH laboratory section).....	Incl....	Incl....	Incl....	Incl....	Incl....	(*)....	(*)....	Incl.
Other mechanical tools.....	Add....	Add....	Add....	Add....	Add....	Add....	Add....	Add.
Manual gasoline pump with hose.....	Add....	Add....	Add....	Add....	Add....	Add....	Add....	Add.
5-gallon gasoline containers.....	Incl....	Incl....	Incl....	Incl....	Incl....	Incl....	Incl....	Incl.
55-gallon gasoline drum.....	Add....	Add....	Add....	Add....	Add....	(*)....	(*)....	Add.

¹ Only one extra filter is supplied. For long-term operation, additional filters would be required.

CODE: (*): Not necessary for this model.

Incl.: Already included with the generator.

Add: Should be obtained locally and stored with generator.

POSTING OF WARNING SIGNS

Warning signs should be printed and placed with the generator or improvised at the time the CDEH is put into operation. The types of signs and the areas where they should be placed are as follows:

DANGER—HIGH VOLTAGE

1. By generator.
2. Near electrical cabinets.
3. Near switches boxes that are "hot."
4. At any spliced cable.
5. At any junction box.

NO SMOKING

1. By generator.
2. Around fuel storage.

AUTHORIZED PERSONNEL ONLY

1. By generator.
2. By control panels.
3. Near switch boxes.

MODEL B, 15-KW.

SUMMARY INSTRUCTIONS

Eseco Division, B-4836

Contract: GS-16956

Follow these instructions carefully

1. Move set to operating position: outdoors and within 80 feet of branch panel location.
 2. Remove packaging. Leave set attached to wooden skid.
 3. Open side, front, and rear panels and remove all shipping straps and items packed within.
 4. Check fan belt tension and tighten into operating position.
 5. Check freedom of movement of generator brushes. Remove any paper or debris.
 6. Set battery where battery acid, if spilled, will do no harm. **FILL BATTERY CAREFULLY. DON'T SPLASH.** Replace and connect leads. Flat, braided strap connects to positive + terminal.
 7. Check radiator and water jacket drain valves and crankcase drain plug to be sure they are closed and snug.
 8. Remove crankcase dipstick.
 9. Fill crankcase with 10W-30 oil or its equivalent. Use $4\frac{1}{2}$ quarts.
 10. Fill air cleaner with same type of oil. Follow instructions on cleaner.
 11. Fill radiator with clean water.
- Note: In cold weather, heating the oil and water before they are added will ease starting. Add antifreeze as required.*
12. Check oil level with dipstick.
 13. Check ignition wires at spark plugs and magneto to see that they are tight.
 14. Fill gasoline tank. Use regular or premium gas.

15. Set controls as follows:

- Main circuit breaker: off.
- Voltage control: knob center.
- Exciter field rheostat: extreme left.
- Fuel valve: open.
- Choke: pull out.
- Throttle: pull out, then push in half way.
- Magnetic switch: on (pull out).

16. Prime carburetor by operating fuel pump manually three or four strokes.

17. Try starter. If battery will not turn over engine, use crank.

Note: Grasp crank handle firmly. Place thumb on same side of crank handle as fingers. Crank by pulling up. Never push down.

18. When engine starts, push choke in slowly as engine warms. Run with choke in all the way.

19. Be sure oil pressure gauge registers at least 25 pounds. If it does not, stop engine and check oil level.

20. Push throttle in all the way; governor will take over.

21. Before starting or while engine warms, connect electrical system as follows:

- a. Remove four 100-foot coils of wire from box under the control panel.
- b. Be sure circuit breaker is in OFF position.
- c. Connect one wire to terminal N on engine control board. Run this wire to neutral of distribution system.
- d. Connect other three wires to terminals 1, 2, and 3, respectively; unroll and connect to phase terminals of distribution system.
- e. Ground the system by driving a piece of iron pipe into the ground near the control panel. Connect it to terminal N by a short piece of wire at least as heavy as AWG No. 10. If there is a water pipe nearby, use that instead of the pipe. Connect terminal N to frame of generator with the same wire.

22. Close circuit breakers on generator control panel. Adjust voltage to 120 volts using voltage adjusting rheostat. Plug in the various items of hospital equipment. Readjust voltage to 120, if necessary.

MODEL J, 15-KW.

SUMMARY INSTRUCTIONS

John R. Hollingsworth Co. JHE-15
Contract: GS-03S-13040

Follow these instructions carefully

1. Move set to operating position: outdoors and within 80 feet of branch panel location.
 2. Remove packaging. Leave set attached to wooden skid.
 3. Open side, front, and rear panels and remove all shipping straps and items packed within.
 4. Check fan belt tension and tighten into operating position.
 5. Check freedom of movement of generator brushes. Remove any paper or debris.
 6. Set battery where battery acid, if spilled, will do no harm. **FILL BATTERY CAREFULLY. DON'T SPLASH.** Replace and connect leads. Flat, braided strap connects to positive + terminal.
 7. Check radiator and water jacket drain valves and crankcase drain plug to be sure they are closed and snug.
 8. Remove crankcase dipstick.
 9. Fill crankcase with 10W-30 oil or its equivalent. Use 4½ quarts.
 10. Fill air cleaner with same type of oil. Follow instructions on cleaner.
 11. Fill radiator with clean water.
- Note: In cold weather, heating the oil and water before they are added will ease starting. Add antifreeze as required.*
12. Check oil level with dipstick.
 13. Check ignition wires at spark plugs and magneto to see that they are tight.
 14. Fill gasoline tank. Use regular or premium gas.

15. Set control as follows:

Main circuit breaker: off.

Ammeter switch: off.

Voltage regulator control switch: off (manual).

Field rheostat knob: extreme left.

Voltage regulator control knob: center.

Throttle: pull out, then push in half way.

Choke: pull out.

Ignition switch: on.

16. Prime carburetor by operating fuel pump manually three or four strokes.

17. Try starter. If battery will not turn over engine, use crank.

Note: Grasp crank handle firmly. Place thumb on same side of crank handle as fingers. Crank by pulling up. Never push down.

18. When engine starts, push choke in slowly as engine warms. Run with choke in all the way.

19. Be sure oil pressure gauge registers at least 20 pounds. If it does not, stop engine and check oil level.

20. Push throttle in all the way; governor will take over.

21. Before starting or while engine warms, connect electrical system as follows:

a. Remove four 100-foot coils of wire from locker on right side.

b. Be sure circuit breaker is in OFF position.

c. Connect one wire to terminal T_0 on engine control board. Run this wire to neutral of distribution system.

d. Connect other three wires to terminals T_1 , T_2 , and T_3 , respectively; unroll and connect to phase terminals of distribution system.

e. Ground the system by driving a piece of iron pipe into the ground near the control panel. Connect it to terminal T_0 by a short piece of wire at least as heavy as AWG No. 10. If there is a water pipe nearby, use that instead of the pipe. Connect terminal T_0 to frame of generator with the same wire.

22. Close circuit breakers on generator control panel. Adjust voltage to 120 volts using voltage adjusting rheostat. Plug in the various items of hospital equipment. Readjust voltage to 120, if necessary.

MODEL K, 15-KW.

SUMMARY INSTRUCTIONS

Winpower Mfg. Co., K-921-1 through K-921-200
Contract: GS-00S2136

Follow these instructions carefully

1. Move set to operating position: outdoors and within 80 feet of branch panel location.
 2. Remove packaging. Leave set attached to wooden skid.
 3. Open side, front, and rear panels and remove all shipping straps and items packed within.
 4. Check fan belt tension and tighten into operating position.
 5. Check freedom of movement of generator brushes. Remove any paper or debris.
 6. Set battery where battery acid, if spilled, will do no harm. **FILL BATTERY CAREFULLY. DON'T SPLASH.** Replace and connect leads. Flat, braided strap connects to positive + terminal.
 7. Check radiator and water jacket drain valves and crankcase drain plug to be sure they are closed and snug.
 8. Remove crankcase dipstick.
 9. Fill crankcase with 10W-30 oil or its equivalent. Use $4\frac{1}{2}$ quarts.
 10. Fill air cleaner with same type of oil. Follow instructions on cleaner.
 11. Fill radiator with clean water.
- Note: In cold weather, heating the oil and water before they are added will ease starting. Add antifreeze as required.*
12. Check oil level with dipstick.
 13. Check ignition wires at spark plugs and magneto to see that they are tight.
 14. Fill gasoline tank. Use regular or premium gas.

15. Set control as follows:

Main circuit breaker: off.

Ammeter switch: off.

Voltage regulator control switch: off (manual).

Manual rheostat knob: extreme left, counterclockwise.

Voltage regulator control knob: center.

Throttle: pull out, then push in half way.

Choke: pull out.

Synchronizing lamp switch: off.

Engine switch: center (push left for start).

16. Prime carburetor by operating fuel pump manually three or four strokes.

17. Try starter. If battery will not turn over engine, use crank.

Note: Grasp crank handle firmly. Place thumb on same side of crank handle as fingers. Crank by pulling up. Never push down.

18. When engine starts, push choke in slowly as engine warms. Run with choke in all the way.

19. Be sure oil pressure gauge registers at least 20 pounds. If it does not, stop engine and check oil level.

20. Push throttle in all the way; governor will take over.

21. Before starting or while engine warms, connect electrical system as follows:

a. Remove four 100-foot coils of wire from box under control panel.

b. Be sure circuit breaker is in off position.

c. Connect one wire to terminal N on left side of control panel. Run this wire to neutral of distribution system.

d. Connect other three wires to terminals A, B, and C, respectively; unroll and connect to phase terminals of distribution system.

e. Ground the system by driving a piece of iron pipe into the ground near the control panel. Connect it to terminal N by a short piece of wire at least as heavy as AWG No. 10. If there is a water pipe nearby, use that instead of the pipe. Connect terminal N to frame of generator with the same wire.

22. Switch voltage regulator control switch to ON (automatic) and adjust voltage regulator control knob to set voltage shown on a.c. voltmeter at 120. Close circuit breaker on control panel and plug in the various items of hospital equipment. Readjust voltage to 120, if necessary.

MODELS M AND U, 15-KW.

SUMMARY INSTRUCTIONS

Model M: Winpower Mfg. Co., M-1000-1 through M-1000-1004
Contract: GS-00S-14625

Model U: Winpower Mfg. Co. U-932-1 through U-932-10
Contract: GS-00S-34986

Follow these instructions carefully

1. Move set to operating position: outdoors and within 80 feet of branch panel location.
 2. Remove packaging. Leave set attached to wooden skid.
 3. Open side, front, and rear panels and remove all shipping straps and items packed within.
 4. Check fan belt tension and tighten into operating position.
 5. Check freedom of movement of generator brushes. Remove any paper or debris.
 6. Set battery where battery acid, if spilled, will do no harm. **FILL BATTERY CAREFULLY. DON'T SPLASH.** Replace and connect leads. Flat, braided strap connects to positive + terminal.
 7. Check radiator and water jacket drain valves and crankcase drain plug to be sure they are closed and snug.
 8. Remove crankcase dipstick.
 9. Fill crankcase with 10W-30 oil or its equivalent. Use 4½ quarts.
 10. Fill air cleaner with same type of oil. Follow instructions on cleaner.
 11. Fill radiator with clean water.
- Note: In cold weather, heating the oil and water before they are added will ease starting. Add antifreeze as required.*
12. Check oil level with dipstick.
 13. Check ignition wires at spark plugs and magneto to see that they are tight.
 14. Fill gasoline tank. Use regular or premium gas.

15. Set control as follows:

Main circuit breaker: off.

Ammeter switch: off.

Voltage regulator control switch: off (manual).

Manual rheostat knob: extreme left.

Voltage regulator control knob: center.

Throttle: pull out, then push in half-way.

Choke: pull out.

Synchronizing lamp switch: off.

Engine switch: center (push left for start).

Oil pressure gauge: press release button.

16. Prime carburetor by operating fuel pump manually three or four strokes.

17. Try starter. If battery will not turn over engine, use crank.

Note: Grasp crank handle firmly. Place thumb on same side of crank handle as fingers. Crank by pulling up. Never push down.

18. When engine starts, push choke in slowly as engine warms. Run with choke in all the way.

19. Be sure oil pressure gauge registers at least 20 pounds. If it does not, stop engine and check oil level.

20. Push throttle in all the way; governor will take over.

21. Before starting or while engine warms, connect electrical system as follows:

a. Remove four 100-foot coils of wire from box under control panel.

b. Be sure circuit breaker is in OFF position.

c. Connect one wire to terminal N on left side of control panel. Run this wire to neutral of distribution system.

d. Connect other three wires to terminals A, B, and C, respectively, unroll and connect to phase terminals of distribution system.

e. Ground the system by driving a piece of iron pipe into the ground near the control panel. Connect it to terminal N by a short piece of wire at least as heavy AWG No. 10. If there is a water pipe nearby, use that instead of the pipe. Connect terminal N to frame of generator with the same wire.

22. Switch voltage regulator control switch to ON (automatic) and adjust voltage regulator control knob to set voltage shown on a.c. voltmeter at 120. Close circuit breaker on control panel and plug in the various items of hospital equipment. Readjust voltage to 120, if necessary.

MODEL G, 10-KW.

SUMMARY INSTRUCTIONS

Hol-Gar Mfg. Corp., GS-107-AC

Specification: PHS-CC-G-202

Follow these instructions carefully

1. Move set to operating position: outdoors and within 80 feet of the load center it will serve.
2. Remove packaging. Leave set attached to wooden skid.
3. Remove shipping straps and dessicant bags.
4. Fill crankcase with 10W-30 oil or its equivalent. Use 6 quarts.
5. Remove the foam air filter element from its wire mesh retainer, soak it in oil of the same type used in the crankcase, squeeze it as dry as possible and replace.
6. Fill fuel tank with regular grade gasoline.
7. Set muffler in place.
8. Check to be sure load switch on control panel is in OFF position.
9. Open fuel valve to TANK position.
10. Prime carburetor by operating fuel pump priming lever about 15 strokes. Be sure level is left in the down (inward) position where it is disengaged.
11. Set engine switch in START position.
12. Adjust hand choke for weather condition. In very cold weather, pull it out most of the way, in warm weather pull it out only a little.
13. Engage crank handle at the "7 o'clock" position and pull it up sharply to the "12 o'clock" position. Two or three such cranks should start the engine.

Note: Grasp crank handle firmly. Place thumb on same side of crank handle as fingers. Never crank by pushing down.

14. Turn engine switch to RUN position.
15. Oil pressure should be at least 20 pounds per square inch. If it is not, stop engine and check oil level.
16. As engine warms, push choke control in slowly until engine runs smoothly with choke all the way in.
17. Before starting or while engine warms, connect electrical system as follows:
 - a. Recheck to be sure that load switch is off.
 - b. Obtain four lengths of No. 6 insulated wire. Connect one of these to the load terminal system marked L_0 and run it to the neutral of the distribution system.
 - c. Connect the other three wires to phase terminals L_1 , L_2 , and L_3 in any order and run to the phase terminals of the distribution system.
 - d. Connect the other generator to its distribution system in the same way.

Note: Be sure that there is NO POSSIBILITY of the two generators being connected in parallel in any way. Such a condition could destroy either or both of them.

- e. Remove the ground rod from its packing position and drive it into the ground near its respective generator. Use the wire provided and connect it to the ground clamp provided on the frame of the generator.
- f. Be sure all branch circuits in the distribution system are off.
- g. Close the load switch on the generator panel and adjust the voltage to 120 volts.
- h. Close the branch circuits of the distribution system one at a time to energize the hospital equipment or other loads in increments not exceeding 3 kw. Readjust the voltage to 120, if necessary.

APPENDIX A

OTHER PUBLICATIONS ON THE CIVIL DEFENSE EMERGENCY HOSPITAL

Establishing the Civil Defense Emergency Hospital (F-1).

X-ray Section of the Civil Defense Emergency Hospital (F-2).

Central Supply Section of the Civil Defense Emergency Hospital (F-3).

Laboratory Section of the Civil Defense Emergency Hospital (F-4).

Checklist for Developing A Civil Defense Emergency Hospital Utilization Plan.

The above publications are available upon request from your State Health Department, Civil Defense Office, or Division of Health Mobilization, Public Health Service, Washington, D.C., 20201.





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ARTIFICIAL RESPIR

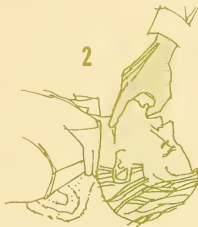
MOUTH-TO-MOUTH or MOUTH-TO-NOSE RESCUE BREATHING

1



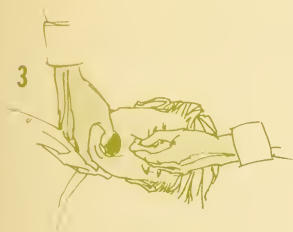
1. PLACE CASUALTY ON BACK IMMEDIATELY. Don't waste time moving to a better place or loosening clothing. QUICKLY CLEAR MOUTH AND THROAT. Remove mucus, food, and other obstructions.

2



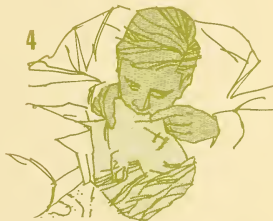
2. TILT HEAD BACK AS FAR AS POSSIBLE. The head should be in a "chin-up" or "sniff" position and the neck stretched. LIFT LOWER JAW FORWARD. Grasp jaw by placing thumb into corner of mouth. Do not hold or depress tongue.

3



3. PINCH NOSE SHUT (OR SEAL MOUTH). Prevent air leakage.

4



4. OPEN YOUR MOUTH WIDE AND BLOW. Take a deep breath and blow forcefully (except for babies) into mouth or nose until you see chest rise. LISTEN FOR EXHALATION. Quickly remove your mouth when chest rises. Lift jaw higher if victim makes snoring or gurgling sounds. REPEAT 12 TO 20 TIMES PER MINUTE. Continue until victim begins to breathe normally.

FOR INFANTS: SEAL BOTH MOUTH AND NOSE WITH YOUR MOUTH. Blow with small puffs or air from your cheeks.

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